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The Real and Financial Implications of the Global Saving Glut: A Three-Country Model

Jean-Baptiste Gossé*

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Abstract: The model presented in this paper has two objectives. First, it models global imbalances in a simple way while conserving real and financial approaches. This double approach is necessary because Global Imbalances are due to the conjunction of financial and real phenomena: the increase in the price of commodities, the accumulation of foreign reserves by the Asian central banks, the limited absorption capacity of the OPEC countries, the insufficient development of the Asian financial system and the perception of better returns in the US.

The second objective is to model the global saving glut hypothesis and to show its implications. We start with a model which consists of three identical countries and then we replicate the current pattern of global imbalances in introducing three asymmetries: a fixed exchange rate between Asia and the United States, a limited absorption capacity in Asia and endogenous propensity to spend in the United States. In order to avoid the recession linked to the increase of their propensity to import, the United States increase their propensity to spend. This adjustment has a cost: (i) the Global Imbalances grow quickly with an increase of current account imbalances and net foreign assets in both the US and Asia ; (ii) the euro area supports an appreciation of its exchange rate which put it in a long depression.

JEL Classification: F21 ; F32 ; F41 ; F47

Key words : International Macroeconomics, Global Imbalances, Balance of Payments, International Finance , Simulation and Forecast

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" The economist with but one model for the analysis of the balance of payments has handicapped him- or herself. [...] sometimes capital drives the current account, sometimes the other way round. "

Kindleberger (1987), p. 11

1 Introduction

During the last years, the Global Imbalances have been increasing. The weight of both current account imbalances and net foreign assets in the 2006 world economy is twice what it was in 1996 (figure 1). If we choose an approach by the real sector, the two big reasons for this growth of Global Imbalances are the increase of oil prices (figure 2) and the under evaluation of the Renminbi (figure 3). The three major players of the GI are the US, for deficits, and the OPEC and the Asian countries, for surpluses. The US suffered the brunt of rising price of oil and the under evaluation of Renminbi and, since the beginning of the millennium, their propensity to spend has been increasing. This paper presents the alternatives of the US to respond to this shock and the consequences of their reactions, first, on the countries with flexible exchange rates and, second, on the countries with fixed exchange rates.

The model presented in this paper has two objectives. First, it models global imbalances in a simple way while conserving real and financial approaches (the Three-Country model presented here is comprised of 50 equations). This double approach is necessary because Global Imbalances are due to the conjunction of financial and real phenomena: the increase in the price of oil, the accumulation of foreign reserves by the Asian central banks (figure 5), the limited absorption capacity of the OPEC countries, the insufficient development of the Asian financial system and the perception of better returns in the US. The second objective is to model the global saving glut hypothesis and to show its implications. We want to demonstrate that in the present context, the increase in the US propensity to spend would offset negative impact on their propensity to import, but with an increase in their net foreign debt. The United States can temporarily avoid a recession by accumulating debts on the rest of the world as long as fixed exchange rate countries accept to accumulate dollar assets. In contrast, the exchange rate of the euro area is the only one to adjust and the impact on European GNP is negative.

The second part briefly describes the evolution in the economic literature on global imbalances. The third part presents the model with three identical flexible exchange rate countries. We introduce the Global Saving Glut Hypothesis in the fourth part.

2 A brief review of the literature on Global Imbalances

The article by Dooley, Folkerts-Landau and Garber (2003) marks the return at the forefront of the issue of current imbalances in economic literature. They argue that the Bretton Woods system has returned so their work has been named Bretton Woods II. The authors consider that the global imbalances of the 2000s result from an export-led growth strategy of Asian countries that is similar to the one adopted by Europe and Japan after the Second World War. In both cases, the surplus countries accumulate reserves so that their exchange rate remains undervalued relative to the dollar. They can maintain their competitiveness and benefit from growth by exports. However, as Eichengreen (2004) pointed out, the resemblance to Bretton Woods is limited. The current international monetary system is a floating exchange rates one and the consistency between the Asian countries in the years 2000 is lower than that of Europe during the 1960s. In addition, the thesis of Bretton Woods II considers the global imbalances resulting from the real sector, i.e. the top of the balance of payments, and the financial sector - i.e. the bottom of the balance of payments - adjust to it.

This vision of global imbalances from the top of the balance of payments is not adopted in the following papers. The Global Saving Glut Hypothesis, supported by Bernanke (2005), assumes that the global imbalances result from both the financial and real sectors. The current account surpluses of the emerging countries have two origins. On the one hand, following the financial crisis of 1997, the Asian emerging countries are accumulating reserves to cover against a possible sudden exit in foreign capital. At the same time, they maintain the under evaluation of their exchange rates, and the exports led their growth. On the other hand, the emergence of new great industrial countries weighs on oil prices. OPEC countries also emit a surplus of savings that they want to invest abroad, since their absorption capacity is limited due to their small population. The saving surplus of the emerging countries leads to the United States, the economy that presents the best features. Bernanke lists the special features that make the U.S. financial sector the most attractive. This is the growth of productivity linked to the development of new technologies, the low political risk, the strong property rights protection or still favorable institutional environment. These inflows of investments lead an appreciation of the dollar, an increase in asset prices and, after 2000, lower interest rates and an increase in household wealth. The combination of these factors motivates households to reduce their savings and increase consumption. Thus, the global savings glut is absorbed by the increase in spending of U.S. households that avoids a recession due to an excess of supply.

The equilibrium model of Caballero, Fahri and Gourinchas (2006) explains growth of GI by the inability of financial systems of certain areas to achieve sufficient investment to use all the savings available. The current pattern of GI and the low global interest rates result from the differences on the financial institutions development in the world and from the greatest potential growth of the United States compared to other financially developed areas. This thesis provides a new element to explain the accumulation of foreign assets by Asian countries beyond the level of reserves to provide assurance against a flight of foreign capital. Furthermore, Caballero et al. (2006), all kinds of models have been developed to represent the evolution of global imbalances. In Obstfeld and Rogoff (2005) the adjustment occurs by changing the preferences between tradable and non tradable goods and between domestic and foreign goods. The model of Blanchard, Giavazzi and Sa (2005) stressed the role of the exchange rate in the allocation of international portfolio. These three models have a major disadvantage that should be overcome: they assume that the GDP are not affected by the adjustments of current imbalances. In the continuous time model with two countries Asada, Chiarella, Flaschel and Franke (2003) and Proaño (2008), the GDP reacts to the adjustment of current imbalances, but they only model the real sector. Finally, models of Lavoie and Zhao (2008), Godley and Lavoie (2007) and Zhao (2006) have the advantage of being stock-flow consistent and of representing both the top and the bottom of the balance of payments. However, they should be simplified (Lavoie, 2008): these three-country models comprise 91, 79 and 89 equations, respectively. In his review of the state of macroeconomics, Blanchard (2008) also argues for smaller models to capture a specific mechanism. He cites Solow including:

" My general preference is for small, transparent, tailored models, often partial equilibrium, usually aimed at understanding some little piece of the (macro-) economic mechanism. "

Solow (2008)

In order to replicate the global imbalances of the 2000s, we use an absorption model to describe the real sector and a portfolio model to describe the financial sector. The interest of such a model is to take into consideration simultaneously factors linked to several interpretations of global imbalances:

- The trade balance approach: the increase of the propensity to import Asian products in the United States and in Europe.
- the absorption approach: the limited absorption capacity in Asian and OPEC countries.
- The saving-investment approach: the consumption of the global saving glut by the United States.

- The portfolio balance approach: the accumulation of reserves in Asian countries to cover against a risk of sudden exit of capitals and the inability of Asian financial systems to absorb the whole domestic saving.

We start with a model which consists of three identical countries and then we replicate the current pattern of global imbalances by introducing three asymmetries: a fixed exchange rate between Asia and the United States, a limited absorption capacity in Asia and an endogenous propensity to spend in the United States.

3 A model of three identical countries with flexible exchange rates

The model is composed of three identical countries. These economies exchange goods and services and hold foreign assets that provide incomes. We assume the three countries are at equilibrium before shocks: trade equilibrium, current account equilibrium, zero net foreign debt and stable exchange rates. The model is divided into two sectors. The real sector (3.1) describes the equations of national income, domestic demand, imports, exports and income balance. The financial sector (3.2) presents the evolution of supply and demand for foreign assets and allows determining the net external position and the exchange rate. Simulations (3.3) illustrate the effect of an increase in the propensity to spend and the impact of a competitiveness shock.

3.1 The real sector

The real sector is represented synthetically in order to focus only on the adjustment mechanisms vis-à-vis the rest of the world. We use a model of absorption *à la* Alexander (1952). The interest of this approach is to focus on macroeconomic, based around expenditure and production in the economy as a whole, in the domestic and international perspectives. When absorption is lower than national income, the country has a current account surplus and vice versa. In the propensity to spend (c), it does not distinguish the propensity to spend of households (1 - s), firms (i) and government (g):

$$c = 1 - s + i + g$$

The subject of the paper is not to explain the government's way of intervening but to define the level of domestic spending that it should attempt to achieve through fiscal, monetary and exchange rate policies. The fiscal policy acts on the budget deficit (g). The monetary policy changes saving and investment levels, in particular, playing on interest rates. Finally, changes

in central bank reserves allow to compensate for current account imbalances without modifying the exchange rate. In the model with flexible exchange rates, the level of domestic expenditure (D) is determined like Samuelson (1939) and Hicks (1956), the propensity to spend of the country (c) and its GNP in the previous period (Y_{t-1}). We assume that before the shock the propensity to spend is equal to one in the three countries 1, 2 and 3: $c^1 = c^2 = c^3 = 1$.

$$D_t^i = c^i \times Y_{t-1}^i \text{ with } i = 1, 2, 3 \quad (1)$$

Imports are defined as standard by levels of expenditure (D) and relative prices (e), approached by the nominal exchange rate (that implies $P^1 = P^2 = P^3 = 1$). Country i's currency is the CU^i and the exchange rate between country i and country j is: $1CU^i = e^{ij}CU^j$. For instance, we use the exchange rate e^{12} to convert CU^2 to CU^1 .

$$IM_t^{ij} = m0^{ij}(D_{t-1}^i)^{m1^{ij}}(e_{t-1}^{ij})^{m2^{ij}} \text{ with } i = 1, 2, 3 ; j = 1, 2, 3 \text{ and } i \neq j \quad (2)$$

We determine country i's propensity to import from country j (μ) by the ratio of imports on expenditures.

$$\mu_t^{ij} = \frac{IM_t^{ij}}{D_t^i} \quad (3)$$

The balance of investment incomes between country i and country j is calculated as the difference between incomes received and incomes paid taking into account exchange rate variations:

$$INC_t^{ij} = (\omega_{t-1}^{ij} W_{t-1}^i r_{t-1}^j \frac{e_{t-1}^{ij}}{e_t^{ij}}) - (\omega_{t-1}^{ji} \frac{W_{t-1}^j}{e_{t-1}^{ij}} r_{t-1}^i) \quad (4)$$

Incomes received from country j are defined by the share (ω^{ij}) of country i's wealth (W^i) invested in country j at the previous period, times the rate of return in country j (r^j), times the exchange rate variation ($\frac{e_{t-1}^{ij}}{e_t^{ij}}$). Incomes paid by country i to country j are defined by the share (ω^{ji}) of country j's wealth (W^j) invested in country i at the previous period, times the rate of return in country i (r^i).

Then, we determine the GNP by the sum of the absorption (or expenditure Overall residents) A , the trade balance (the difference between exports and imports) $X - IM$ and the income balance INC .

$$Y = A + (X - IM) + INC$$

with $D = A + IM$

The GNP corresponds to domestic demand (the first member), plus exports (the second and third members), plus net income investment (fourth and fifth members).

$$Y_t^i = (1 - \mu_t^{ij} - \mu_t^{ik})D_t^i + \mu_t^{ji}(D_t^j)e_t^{ij} + \mu^{ki}(D_t^k)e_t^{ki} + INC_t^{ij} + INC_t^{ik} \quad (5)$$

with $i = 1, 2, 3 ; j = 1, 2, 3 ; k = 1, 2, 3$ and $i \neq j \neq k$

The real sector allows for determining the trade balance. The trade deficit (TD) is the difference between imports and exports expressed in domestic currency:

$$TD_t^{ij} = IM_t^{ij} - e_t^{ji} \times IM_t^{ji} \quad (6)$$

3.2 The financial sector

A portfolio model *à la* Kouri (1981) which incorporates the mechanical of Blanchard et al. model (2005) represents the financial sector. It is used to determine exchange rates. The propensity to hold foreign assets is determined in accordance with the *horizontal constraint* of Godley (1996), i.e., for each equation, the sum of all rates of return coefficients (λ) is equal to zero. For the sake of simplicity, we assume that the rates of return are the same in the three countries ($r^1 = r^2 = r^3$).

$$\omega_t^{ij} = \lambda 0^{ij} - \lambda 1^{ij}(r_t^i) + \lambda 2^{ij}(r_t^j) - \lambda 3^{ij}(r_t^k) \quad (7)$$

Net foreign debt is equal to the value of assets held by foreign investors in the country, minus the value of assets held by domestic investors abroad, plus the trade deficit vis-à-vis the foreign country.

$$NFD_t^{ij} = \omega_{t-1}^{ji} \frac{W_{t-1}^j}{e_{t-1}^{ij}} (1 + r_{t-1}^i) - \omega_{t-1}^{ij} W_{t-1}^i (1 + r_{t-1}^j) \frac{e_{t-1}^{ij}}{e_t^{ij}} + TD_t^{ij} \quad (8)$$

The quantity of the assets held by investors from country j in country i is equal to the share (ω^{ji}) of country j's wealth (W_{t-1}^j) held in country i during the previous period, times the exchange rate between country i and country j ($1CU^j = e^{ji}CU^i$), times the rate of return of country i's assets in CU^i ($1 + r_{t-1}^i$). The value of assets held by investors from country i in country

j is equal to the share of country i's wealth of the previous period (W_{t-1}^i), times the propensity to hold assets of country j (ω_{t-1}^{ij}), times the rate of return on assets of country j in CU^i ($(1 + r_{t-1}^j) \times \frac{e_{t-1}^{ij}}{e_t^{ij}}$).

The supply of domestic assets BS is given by a ratio κ of GNP Y :

$$BS_t^i = \kappa^i(Y_t^i) \quad (9)$$

For the sake of clarity, we set: $\kappa^1 = \kappa^2 = \kappa^3 = 1$ (assuming that the supply of assets is the same size as GNP). The domestic wealth (W) is equal to the supply of domestic assets (BS) minus the net foreign debt NFD expressed in home currency.

$$W_t^i = BS_t^i - NFD_t^{ij} - NFD_t^{ik} \quad (10)$$

The exchange rate e^{ij} (to convert country j's currency into country i's currency) is defined so as to equalize the liabilities of country i and the assets of country j:

$$e_t^{ij}[NFD_t^{ij} + \omega_t^{ij}(W_t^i)] = \omega_t^{ji}(W_t^j)$$

We replace W^i and W^j by their expressions:

$$W_t^i = BS_t^i - NFD_t^{ij} - NFD_t^{ik}$$

$$W_t^j = BS_t^j + (NFD_t^{ij})e_t^{ij} - NFD_t^{jk}$$

We get the following expression:

$$e_t^{ij}[NFD_t^{ij} + \omega_t^{ij}(BS_t^i - NFD_t^{ij} - NFD_t^{ik})] = \omega_t^{ji}[BS_t^j + (NFD_t^{ij})e_t^{ij} - NFD_t^{jk}]$$

This equation determines the exchange rate between country i and country j:

$$e_t^{ij} = \frac{\omega_t^{ji}(BS_t^j) - NFD_t^{jk}}{\omega_t^{ij}(BS_t^i - NFD_t^{ik}) + (1 - \omega_t^{ji} - \omega_t^{ij})NFD_t^{ij}} \quad (11)$$

We remark that as in the Blanchard et al. model, the higher the assets supply, the lower the exchange rate variation resulting from current account imbalances. Furthermore, as country j's net foreign debt vis-à-vis country k increases, the country i's currency is weakened compared to country j's currency, because the country j's assets supply available in country i decreases. Similarly, when country i's net foreign debt vis-à-vis country k increases, its exchange rate appraises because country i's assets supply available in country j decreases.

3.3 The simulations in a world without asymmetries

3.3.1 Scénario 1: a shock on country 1's propensity to spend

Country 1's propensity to spend increases from 1 to 1.005 (*figure 3*). This rise provokes an increase of country 1's GNP and a growth of assets supply. As a result, country 1's currency is depreciated compared to two other countries currencies. The competitiveness of country 1 increases so it releases a trade surplus, a current account surplus and its net foreign position improves. Its trade surplus is shrinking gradually with the growth of its GNP but its current account surplus continues to increase because trade surplus reduction is offset by an elevation of the net income related to the depreciation of its currency.

3.3.2 Scenario 2: a shock on the propensity to import of countries 1 and 2

In countries 1 and 2, the propensity to import goods made in country 3 passes from 0.05 to 0.055 (*figure 4*). The GNP of countries 1 and 2 decrease while that of country 3 increases. The currencies of countries 1 and 2 depreciate relative to the country 3 to return to current account equilibrium. As a first step, the country 3's trade balance surplus allows it to accumulate assets in the rest of the world. As a second step, the country 3 recorded a trade deficit which is offset by the receipt of net income. A new equilibrium is established in which the country 3 consumes more goods than it produces because the balance of investment incomes procures him a rent. Thus, in a "perfect world" without asymmetries, productivity shocks are adjusted by exchange rate changes and do not generate global imbalances. Results of simulations under flexible exchange rates are presented in table 2.

4 Modeling the global saving glut hypothesis

We start from the previous three-country model to describe the relationships between the three major areas that currently interact. The country 1 is the United States who hold the currency on which some countries are pegged. The country 2 is named the *euro area* and it comprises flexible exchange rates countries. The country 3 is named *Asia* and it includes fixed exchange rates countries. However, this model does not describe the current global imbalances since it ignores several key features of the global economy. We introduce three asymmetries in the previous model in order to replicate the global imbalances of the 2000s and to show their implications on growth.

First, some countries have fixed exchange rates so the Asian propensity to hold foreign securities must be determined to leave unchanged its exchange rate vis-à-vis the dollar (4.1). Second, the limited absorption capacity of OPEC and Asia should be taken into account (4.2). Third, the Bernanke's global saving glut hypothesis is described by a model endogenizing the American propensity to spend to maintain the income of the United States unchanged (4.3). Simulations show the effects of expansionary politics, of under-evaluation of the Renminbi and of the absorption by the United States of the global saving glut (4.4).

4.1 First asymmetry: Asia pegs its currency on the dollar

In this case, the adjustment is made by modifying the Asian home bias as long as it agrees to acquire securities issued to offset the current account imbalance. The home bias compatible with a fixed exchange rate allows equalizing supply and demand for U.S. assets without modifying exchange rates:

$$[NFD_t^{13} + \omega_t^{13}(W_t^1)]e_t^{13} = \omega_t^{31}(W_t^3)$$

We replace W^1 and W^3 by their expressions and we get the following expression:

$$[NFD_t^{13} + \omega_t^{13}(BS_t^1 - NFD_t^{13} - NFD_t^{12})]e_t^{13} = \omega_t^{31}(BS_t^3 + NFD_t^{13}e_t^{13} - NFD_t^{32})$$

This equation gives the level of home bias that adjusts current account imbalances while maintaining the exchange rate unchanged:

$$\omega_t^{31} = \frac{\omega_t^{13}(BS_t^1 - NFD_t^{12}) + (1 - \omega_t^{13})NFD_t^{13}}{\frac{BS_t^3 - NFD_t^{32}}{e_t^{13}} + NFD_t^{13}} \quad (12)$$

Since Asia is in fixed exchange rates vis-à-vis the United States, this equation replaces the equation of the exchange rate between the United States and Asia in the previous model.

4.2 Second asymmetry: the limited absorption capacity of fixed exchange rates countries

The absorption capacity of country 3 is limited for two reasons. On the one hand, we assume that Asia reach its maximum absorption capacity because its financial system is not able to use domestic saving. On the other

hand, the absorption capacity of OPEC countries is limited due to their small population. We model this dual limit by assuming that the level of expenditure of the country 3 is fixed $\Delta D^3 = 0$. Then the propensity to spend adjusts changes in income:

$$c_t^3 = \frac{D^3}{Y_{t-1}^3} \quad (13)$$

This equation replaces equation 3 of the previous model.

4.3 Third asymmetry: the U.S. propensity to spend is endogenized to maintain constant U.S. GNP

We determine the level of the U.S. propensity to spend that can avoid a recession in the United States resulting from country 3's current account surplus. The level of propensity to spend which can absorb the shock c^{1*} is determined in Brender and Pisani (2007). We highlight the equilibrium values (pre-shock). As a first step, we equalize pre-shock income \bar{Y}^1 with post-shock income Y^1 :

$$Y^1 = \bar{Y}^1$$

With $D^3 = \bar{D}^3$, $D^1 = c^1(Y_{t-1}^1)$ and $c^1 = 1$, so it comes:

$$(1 - \mu_t^{12} - \mu_t^{13})c^{1*}(Y_{t-1}^1) + \mu_t^{21}(D_t^2)e_t^{21} + \mu_t^{31}(D^3)e_t^{31} + INC_t^{12} + INC_t^{13} = (1 - \bar{\mu}^{12} - \bar{\mu}^{13}) \times Y_{t-1}^1 + \bar{\mu}^{21}(\bar{D}^2)\bar{e}^{21} + \bar{\mu}^{31}(D^3)\bar{e}^{31} + \bar{INC}^{12} + \bar{INC}^{13}$$

Then we determine the level of c^{1*} which maintain the American GNP constant after a competitiveness shock:

$$c^{1*} = \frac{\bar{\mu}^{21}(\bar{D}^2)\bar{e}^{21} - \mu_t^{21}D_t^2e_t^{21} + D^3[\bar{\mu}^{31}(\bar{e}^{31}) - \mu_t^{31}(e_t^{31}) - INC_t^{12} - INC_t^{13}]}{(1 - \mu_t^{12} - \mu_t^{13})Y_{t-1}^1} + \frac{1 - \bar{\mu}^{12} - \bar{\mu}^{13}}{1 - \mu_t^{12} - \mu_t^{13}} \quad (14)$$

To avoid a global recession, the U.S. must increase their propensity to spend c^1 in order to compensate for the reduction in Asia c^3 .

4.4 The simulations

The first two simulations are under asymmetries 1 and 2. In this case, the productivity shock implies a growth of global imbalances and a recession

in the United States and in Europe. When we introduce the third asymmetry, the US GNP is stabilized, but the global imbalances are bigger and the negative effect on the European GNP is stronger. The results of these simulations are summarized in table 3.

4.4.1 Scenario 1: a shock on the U.S. propensity to spend without global saving glut hypothesis

The U.S. propensity to spend rises from 1 to 1.005. The supply of U.S. securities and the American GNP increase (*figure 5*). The result is a depreciation of the dollar vis-à-vis the euro and an increase in Asian reserves to avoid an appreciation of $\text{\$}$. The increase in the GNP generates a trade deficit vis-à-vis Asia that is partly offset by a surplus vis-à-vis Europe. The euro area has a trade deficit with the United States and Asia as the euro appreciates against currencies of both countries. The net external debt of the United States and Europe increase and their net income is negative. Finally, Asia has a current account surplus and the United States and Europe a deficit. The European GNP decreases and that of Asia expands.

4.4.2 Scenario 2: a shock on the propensity to import of countries 1 and 2 without global saving glut hypothesis

The propensity to import Asian products to the United States and Europe increased from 0.05 to 0.055 (*figure 6*). The trade balances of both economies decline while Asia has a surplus. The trade balances tend to return to equilibrium with the depreciation of the euro vis-à-vis both Asian and American currencies and with the decline of European and U.S. GNP. Asia accumulates U.S. assets in order to avoid an appreciation of its currency. This accumulation leads to an increase of Asian net incomes. The U.S. GNP diminishes gradually to adjust the shock. The European GNP is reduced and then stabilized after the euro has depreciated. Finally, the increase of U.S. and European propensity to import causes a global recession and growing global imbalances.

4.4.3 Scenario 3: a shock on the propensity to import from countries 1 and 2 with global saving glut hypothesis

In this case, the propensity to spend of the United States adjusts itself in order to maintain their GNP unchanged following the increase in their propensity to import Asian products (*figure 7*). The dollar depreciates against the euro since the effect of the propensity to spend is stronger than

the one of the propensity to import. Asia accumulates U.S. assets to maintain the level of its exchange rate with the dollar. The trade and current account imbalances persist. Thus, global imbalances grow rapidly: the current account deficit and the net foreign debt of the United States continue to rise as the current account surplus and the net foreign assets of Asia. External imbalances in the Euro area are less important. The adjustment takes place through the gradual reduction of European GNP that is linked to the deteriorating competitiveness.

The results of simulations under the global saving glut hypothesis are very close to the evolution of the pattern of global imbalances in the 2000s. The trend in the current account imbalances are similar to a surplus in Asia and a deficit in the United States (figure 11). However, according to the simulation, the euro area should be in deficit but the observations show a different trend around the equilibrium. The trends in net foreign debts are very akin observations: a growing net debt in the United States, a soaring net stock of assets in Asia and a smoothly increasing net debt in the euro area (figure 12).

5 Conclusion

The model includes a real and financial approach of global imbalances. The three-country model only has 50 equations – or about half of the models of Zhao (2006), Godley and Lavoie (2007) and Lavoie and Zhao (2008) – although, unlike the models of Obstfeld and Rogoff (2005), Blanchard et al (2005) and Caballero et al (2006), it does not involve a constant GNP. Thus, we can observe both the real and financial implications of the shocks.

A first series of simulations is conducted in a model with three identical countries under flexible exchange rates. The increase in the propensity to import country 3's products in countries 1 and 2 causes a reduction of the GNP of both countries and provokes small external imbalances that stabilize after the depreciation of exchange rates. Then, we introduce three asymmetries in order to model the global saving glut hypothesis. First, the Asia-OPEC area is pegged on the dollar. Second, we assume a limited absorption capacity in fixed exchange rates countries tied to the small population in the OPEC countries and to the limited financial development in Asia. Third, under the Bernanke's global saving glut hypothesis, it is assumed that the United States raise their propensity to spend in order to maintain their GNP stable following an increase in their propensity to import.

Under the first two constraints, the productivity shock implies the stagnation of Asian GNP and a strong negative effect on US GNP and that of the euro area. By adding the third asymmetry, it appears that the recession can be avoided in the United States if they increase their propensity to

spend. However, the consequences for the global economy would be disastrous: global imbalances grow very fast and the euro area experiences a deep recession. Finally, we find that the trend of simulations are very close to the observed trends of the pattern of global imbalances both in stocks and in flows.

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6 Appendix

A Parameters

We remark that:

- in the flexible exchange rates model there are 50 endogenous equations for 50 equations,
- the model with a fixed exchange rate between the U.S. and Asia has 49 equations for 49 endogenous variables,
- when we introduce the *global saving glut hypothesis*, there are 50 equations for 50 unknowns.

| United States | | | | Euro area | | | | Asia | | | |
|---------------|---|---------------------------|---------------|-----------|---|------------|---------------|-----------|---|---------------------------|---------------|
| Notations | Description | Status | Initial value | Notations | Description | Status | Initial value | Notations | Description | Status | Initial value |
| c1 | Propensity to spend | exogenous/ endogenous* | 1 | c2 | Propensity to spend | exogenous | 1 | c3 | Propensity to spend | exogenous/ endogenous* | 1 |
| k1 | supply of domestic assets/GDP ratio | exogenous | 1 | k2 | supply of domestic assets/GDP ratio | exogenous | 1 | k3 | supply of domestic assets/GDP ratio | exogenous | 1 |
| ex | exchange rate (1 \$ = ex £) | endogenous/ exogenous* | 1 | ex/e | exchange rate (1 £ = ex/e \$) | implicit | 1 | 1/ex | exchange rate (1 £ = 1/ex \$) | implicit | 1 |
| m120 | constant in the equation of imports of European products | exogenous | 0.05 | m210 | constant in the equation of imports of American products | exogenous | 0.05 | m310 | constant in the equation of imports of American products | exogenous | 0.05 |
| m121 | income elasticity in the equation of imports of European products | exogenous | 1 | m211 | income elasticity in the equation of imports of American products | exogenous | 1 | m311 | income elasticity in the equation of imports of American products | exogenous | 1 |
| m122 | price elasticity in the equation of imports of European products | exogenous | 1 | m212 | price elasticity in the equation of imports of American products | exogenous | 1 | m312 | price elasticity in the equation of imports of American products | exogenous | 1 |
| m130 | constant in the equation of imports of Asian products | exogenous | 0.05 | m230 | constant in the equation of imports of Asian products | exogenous | 0.05 | m320 | constant in the equation of imports of European products | exogenous | 0.05 |
| m131 | income elasticity in the equation of imports of Asian products | exogenous | 1 | m231 | income elasticity in the equation of imports of Asian products | exogenous | 1 | m321 | income elasticity in the equation of imports of European products | exogenous | 1 |
| m132 | price elasticity in the equation of imports of Asian products | exogenous | 1 | m232 | price elasticity in the equation of imports of Asian products | exogenous | 1 | m322 | price elasticity in the equation of imports of European products | exogenous | 1 |
| r1 | interest rate | exogenous | 0.04 | r2 | interest rate | exogenous | 0.04 | r3 | interest rate | exogenous | 0.04 |
| λ120 | constant in the propensity to hold European assets equation | exogenous | 0.1 | λ210 | constant in the propensity to hold American assets equation | exogenous | 0.1 | λ310 | constant in the propensity to hold American assets equation | exogenous | 0.1 |
| λ121 | coefficient on r1 in propensity to hold European assets equation | exogenous | 0.2 | λ211 | coefficient on r1 in propensity to hold American assets equation | exogenous | 0.4 | λ311 | coefficient on r1 in propensity to hold American assets equation | exogenous | 0.4 |
| λ122 | coefficient on r2 in propensity to hold European assets equation | exogenous | 0.4 | λ212 | coefficient on r2 in propensity to hold American assets equation | exogenous | 0.2 | λ312 | coefficient on r2 in propensity to hold American assets equation | exogenous | 0.2 |
| λ123 | coefficient on r3 in propensity to hold European assets equation | exogenous | 0.2 | λ213 | coefficient on r3 in propensity to hold American assets equation | exogenous | 0.2 | λ313 | coefficient on r3 in propensity to hold American assets equation | exogenous | 0.2 |
| λ130 | constant in the propensity to hold Asian assets equation | exogenous | 0.1 | λ230 | constant in the propensity to hold Asian assets equation | exogenous | 0.1 | λ320 | constant in the propensity to hold European assets equation | exogenous | 0.1 |
| λ131 | coefficient on r1 in propensity to hold Asian assets equation | exogenous | 0.2 | λ231 | coefficient on r1 in propensity to hold Asian assets equation | exogenous | 0.2 | λ321 | coefficient on r1 in propensity to hold European assets equation | exogenous | 0.2 |
| λ132 | coefficient on r2 in propensity to hold Asian assets equation | exogenous | 0.2 | λ232 | coefficient on r2 in propensity to hold Asian assets equation | exogenous | 0.2 | λ322 | coefficient on r2 in propensity to hold European assets equation | exogenous | 0.4 |
| λ133 | coefficient on r3 in propensity to hold Asian assets equation | exogenous | 0.4 | λ233 | coefficient on r3 in propensity to hold Asian assets equation | exogenous | 0.4 | λ323 | coefficient on r3 in propensity to hold European assets equation | exogenous | 0.2 |
| ω12 | propensity to hold European assets | endogenous | 0.2 | ω21 | propensity to hold American assets | endogenous | 0.2 | ω31 | propensity to hold American assets | endogenous* | 0.2 |
| ω13 | propensity to hold Asian assets | endogenous | 0.2 | ω23 | propensity to hold Asian assets | endogenous | 0.2 | ω33 | propensity to hold European assets | endogenous | 0.2 |
| D1 | domestic demand | endogenous | 100 | D2 | domestic demand | endogenous | 100 | D3 | domestic demand | endogenous/ exogenous | 100 |
| IM12 | imports of European products | endogenous | 5 | IM21 | imports of American products | endogenous | 5 | IM31 | imports of American products | endogenous | 5 |
| IM13 | imports of Asian products | endogenous | 5 | IM23 | imports of Asian products | endogenous | 5 | IM32 | imports of European products | endogenous | 5 |
| μ12 | propensity to import European products | endogenous | 0.05 | μ21 | propensity to import American products | endogenous | 0.05 | μ31 | propensity to import American products | endogenous | 0.05 |
| μ13 | propensity to import Asian products | endogenous | 0.05 | μ23 | propensity to import Asian products | endogenous | 0.05 | μ32 | propensity to import European products | endogenous | 0.05 |
| Y1 | GNP | endogenous | 100 | Y2 | GNP | endogenous | 100 | Y3 | GNP | endogenous | 100 |
| DC12 | commercial deficit vis-à-vis the euro area | endogenous | 0 | DC21 | commercial deficit vis-à-vis the United States | endogenous | 0 | DC31 | commercial deficit vis-à-vis the United States | endogenous | 0 |
| DC13 | commercial deficit vis-à-vis Asia | endogenous | 0 | DC23 | commercial deficit vis-à-vis Asia | endogenous | 0 | DC32 | commercial deficit vis-à-vis the euro area | endogenous | 0 |
| NFD12 | net foreign debt vis-à-vis the euro area | endogenous | 0 | NFD21 | net foreign debt vis-à-vis the United States | endogenous | 0 | NFD31 | net foreign debt vis-à-vis the United States | endogenous | 0 |
| NFD13 | net foreign debt vis-à-vis Asia | endogenous | 0 | NFD23 | net foreign debt vis-à-vis Asia | endogenous | 0 | NFD32 | net foreign debt vis-à-vis the euro area | endogenous | 0 |
| BS1 | supply of domestic assets | endogenous | 100 | BS2 | supply of domestic assets | endogenous | 100 | BS3 | supply of domestic assets | endogenous | 100 |
| W1 | national wealth | endogenous | 100 | W2 | national wealth | endogenous | 100 | W3 | national wealth | endogenous | 100 |
| INC12 | Net income transfers between U.S. and European | endogenous | 0 | INC21 | Net income transfers between U.S. and European | endogenous | 0 | INC31 | Net income transfers between U.S. and Asian | endogenous | 0 |
| INC13 | Net income transfers between U.S. and Asian | endogenous | 0 | INC23 | Net income transfers between European and Asian | endogenous | 0 | INC32 | Net income transfers between European and Asian | endogenous | 0 |
| e | exchange rate (1 \$ = e £) | endogenous | 1 | 1/e | exchange rate (1 £ = 1/e \$) | implicit | 1 | e/ex | exchange rate (1 £ = e/ex \$) | implicit | 1 |

* the first term indicates the status of the variable in the first model in flexible exchange rates, the second term indicates the status of the variable when the country is in 3 fixed exchange and the assumption of surplus global savings is made.

Table 1: Values of model parameters

| | GDP (Y) | | | Exchange rate | | | Current account balance | | | Net foreign assets (-NFD) | | |
|---|-----------|-----------|-----------|---------------|-----------|----------|-------------------------|-----------|-----------|---------------------------|-----------|-----------|
| | Country 1 | Country 2 | Country 3 | 1\$ = e € | 1\$ = e ¥ | 1€ = e ¥ | Country 1 | Country 2 | Country 3 | Country 1 | Country 2 | Country 3 |
| Shock on US propensity to spend ($\uparrow c1$) | + | - | - | - | - | 0 | + | - | - | + | - | - |
| Shock on propensity to import Asian goods of the United States and of the euro area ($\uparrow \mu13$ and $\uparrow \mu23$) | - | - | + | 0 | - | - | -(0) | -(0) | +(0) | - | - | + |

Table 2: Results under flexible exchange rates (long term effects in brackets)

| | GDP (Y) | | | Exchange rate | Asian propensity to hold US assets | Current account balance | | | Net foreign assets (-NFD) | | |
|--|---------------|-----------|------|---------------|------------------------------------|-------------------------|-----------|------|---------------------------|-----------|------|
| | United States | Euro area | Asia | | | United States | Euro area | Asia | United States | Euro area | Asia |
| Shock on US propensity to spend ($\uparrow c1$) | + | - | + | - | + | - | - | + | - | - | + |
| Shock on propensity to import Asian goods of the United States and of the euro area ($\uparrow \mu13$ and $\uparrow \mu23$) | - | - | + | + | + | - | -(0) | + | - | -(small) | + |
| Shock on propensity to import Asian goods of the United States and of the euro area ($\uparrow \mu13$ and $\uparrow \mu23$) with an endogenous US propensity to spend ($c1$) | 0 | - | + | - | + | - | - | + | - | -(small) | + |

Table 3: Results under fixed exchange rates (long term effects in brackets)

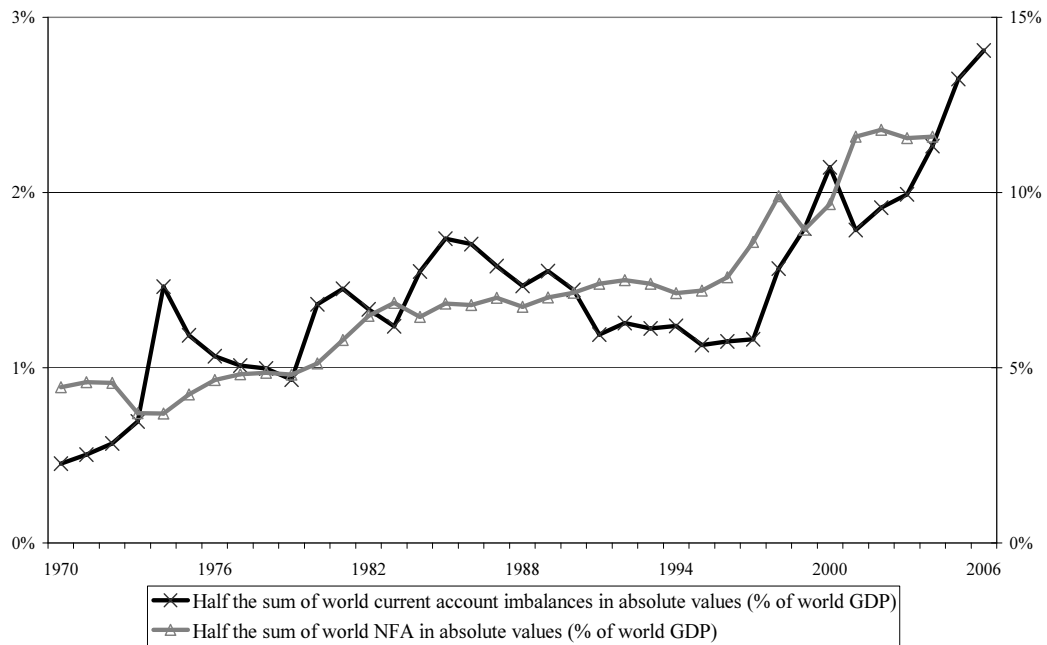


Figure 1: Evolution of global imbalances in flows and stocks
Source: CEPII-Chelem, Lane and Milesi-Ferretti (2007)

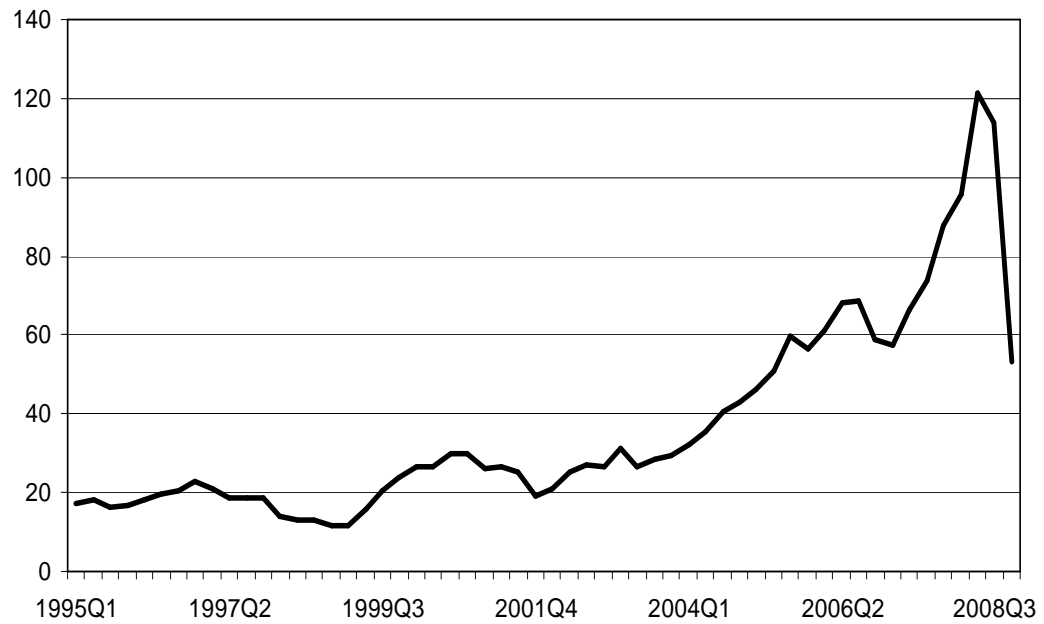


Figure 2: Evolution of the crude oil price (dollars a barrel)Source: IMF, IFS

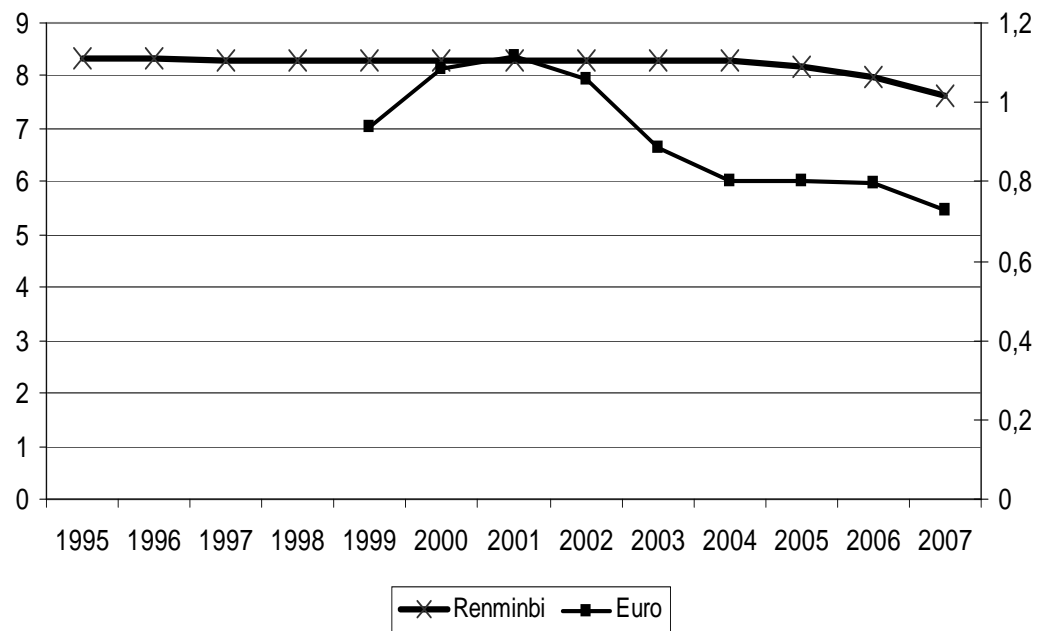


Figure 3: Evolution of the US exchange rate vis-à-vis China and the euro area ($1\$ = e \times CUR$)
Source: OECD, Eurostat

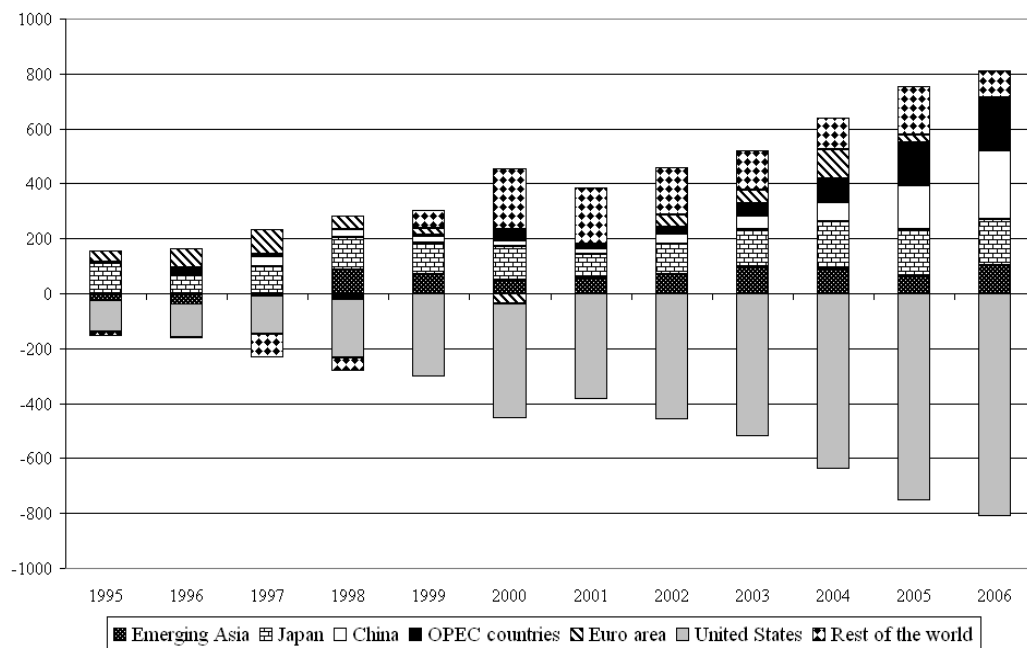


Figure 4: Evolution of current account imbalances (in billions of dollars)
Source: CEPII-Chelem

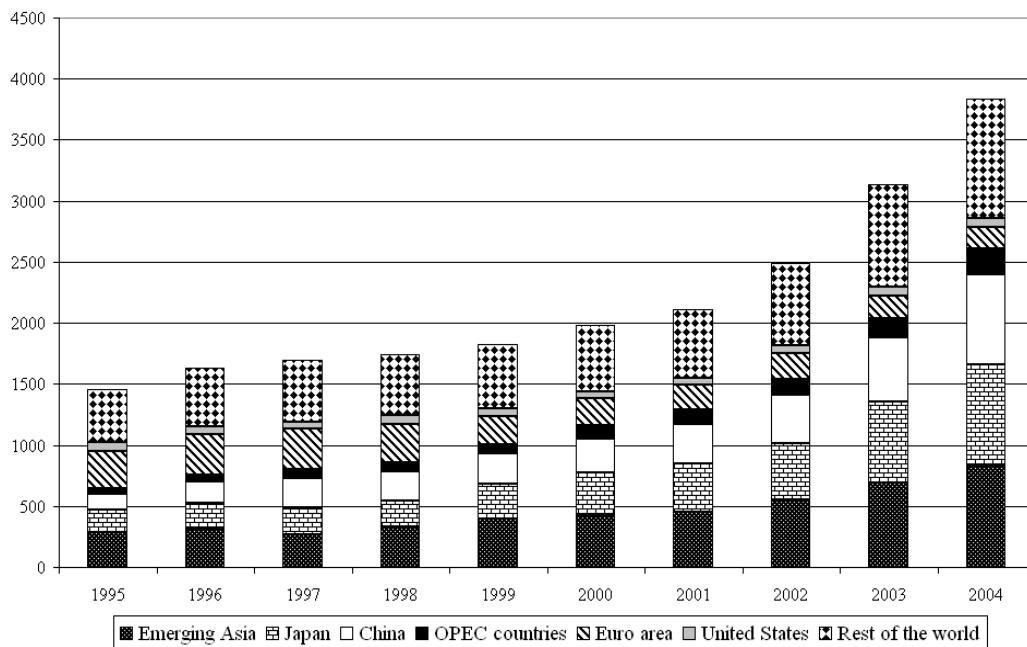


Figure 5: Evolution of reserves minus gold (in billions of dollars)
Source: Lane and Milesi-Ferretti (2007)

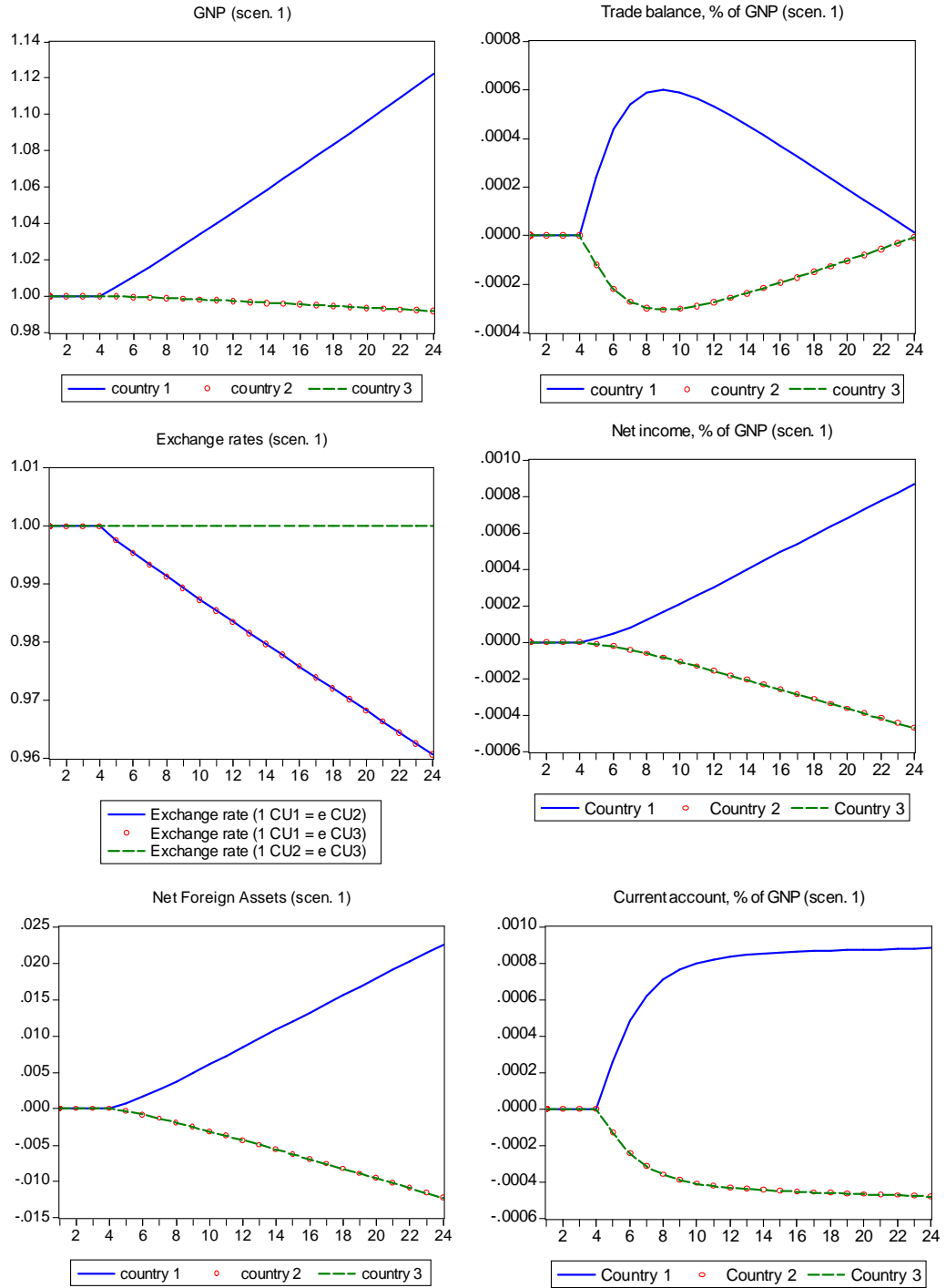


Figure 6: Country 1's propensity to spend increases from 1 to 1.005, in flexible exchange rates

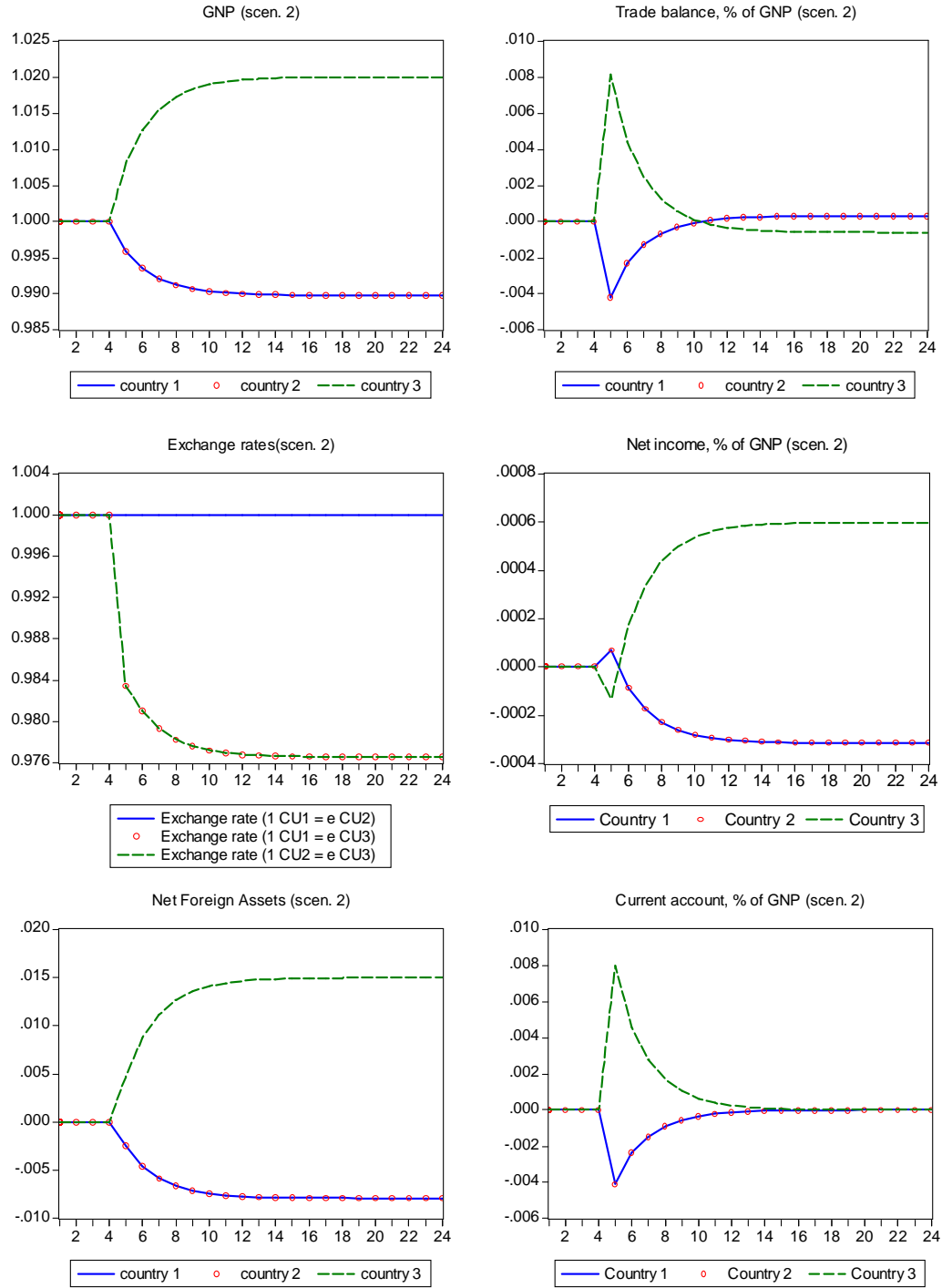


Figure 7: The propensities to import goods made in country 3 passe from 0.05 to 0.055, in flexible exchange rates

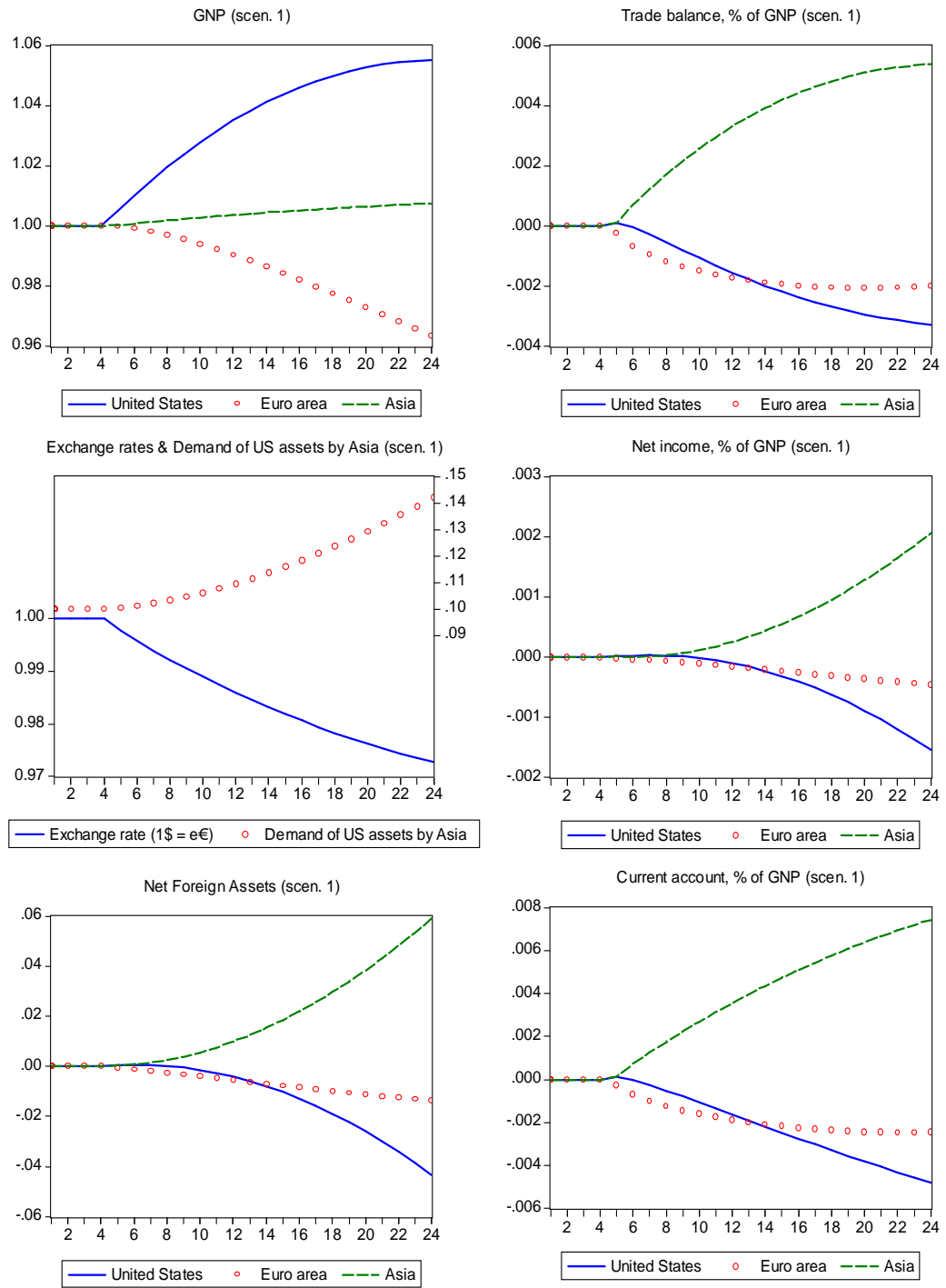


Figure 8: The US propensity to spend increases from 1 to 1.005, with fixed exchange rates and limited absorption capacity

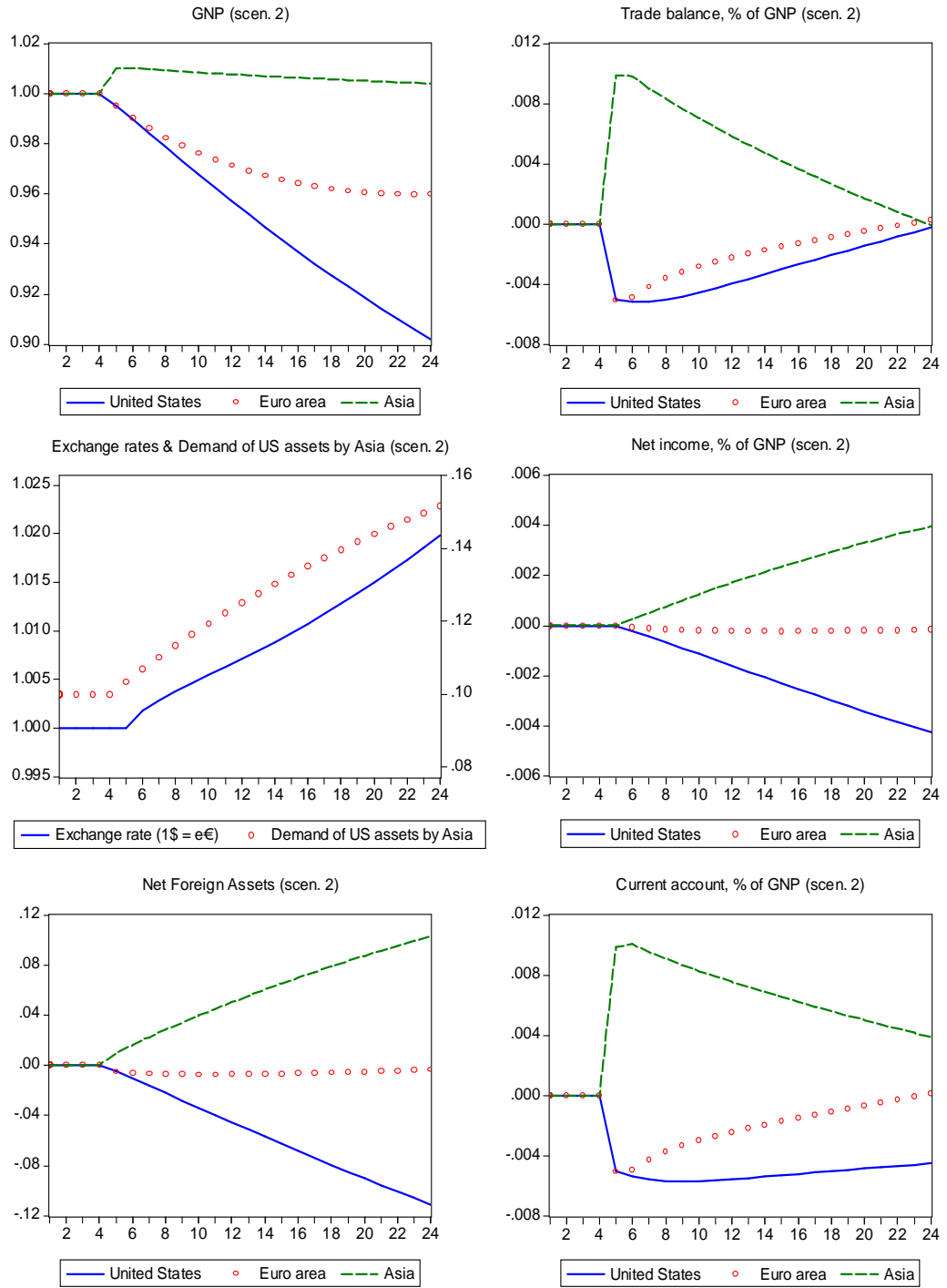


Figure 9: The propensities to import Asian goods to the United States and to the euro area pass from 0.05 to 0.055, with fixed exchange rates and limited absorption capacity

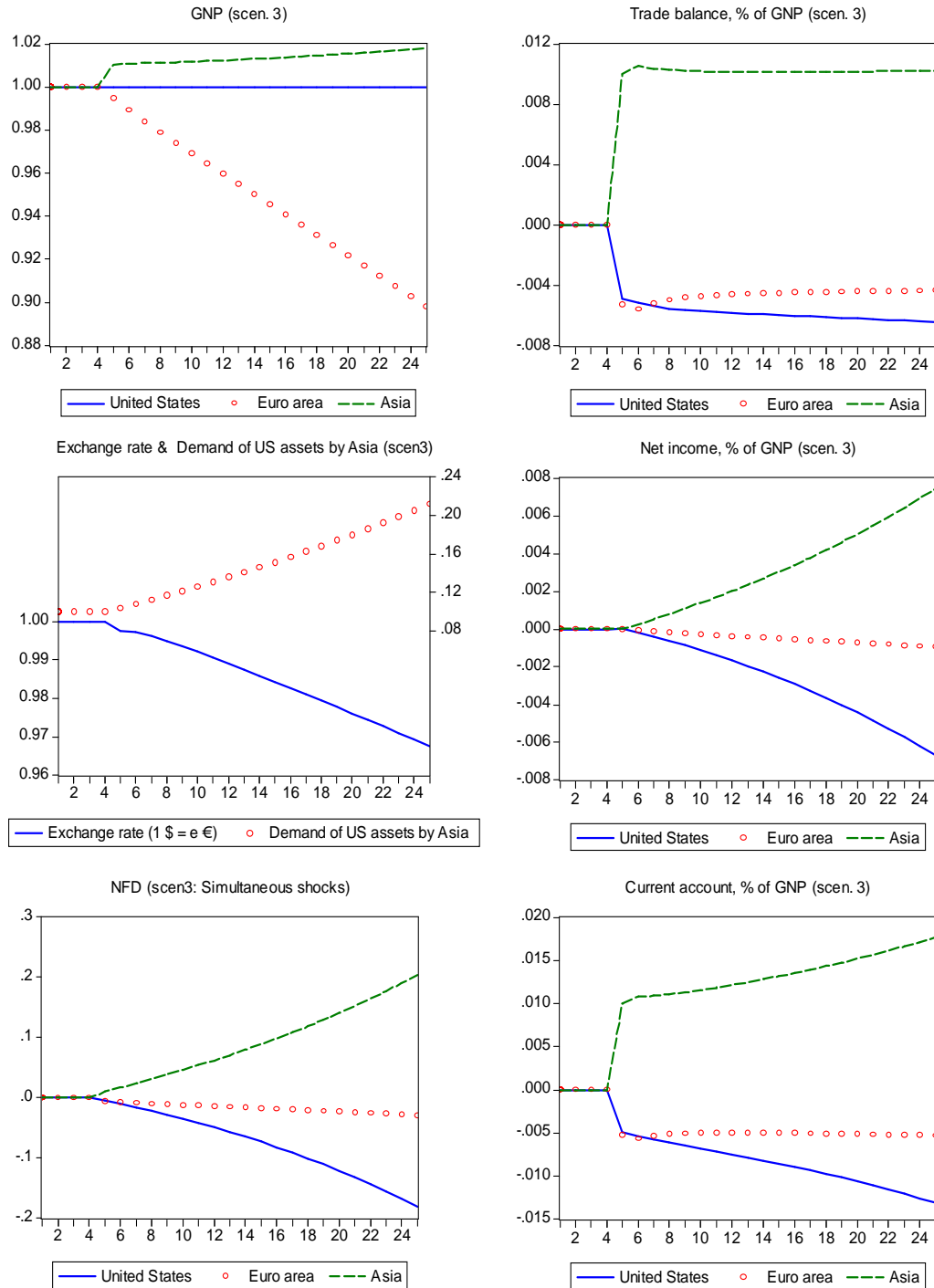


Figure 10: Global saving glut hypothesis: the propensities to import Asian goods to the United States and to the euro area passe from 0.05 to 0.055, with fixed exchange rates, limited absorption capacity and endogenous US propensity to spend

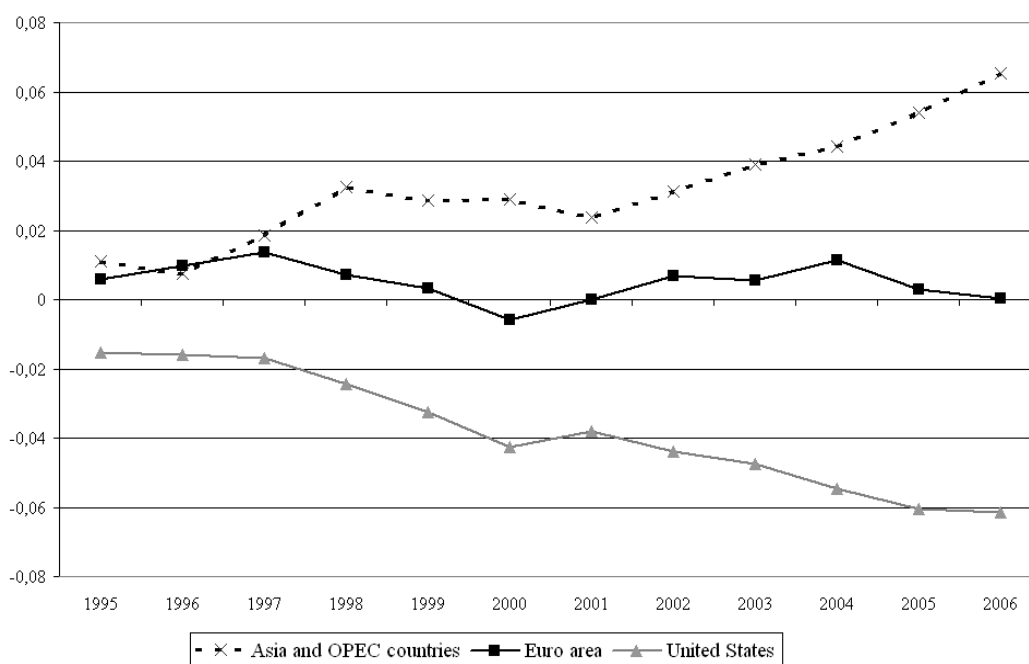


Figure 11: Evolution of current account imbalances (% of GDP)
Source: CEPII-Chelem

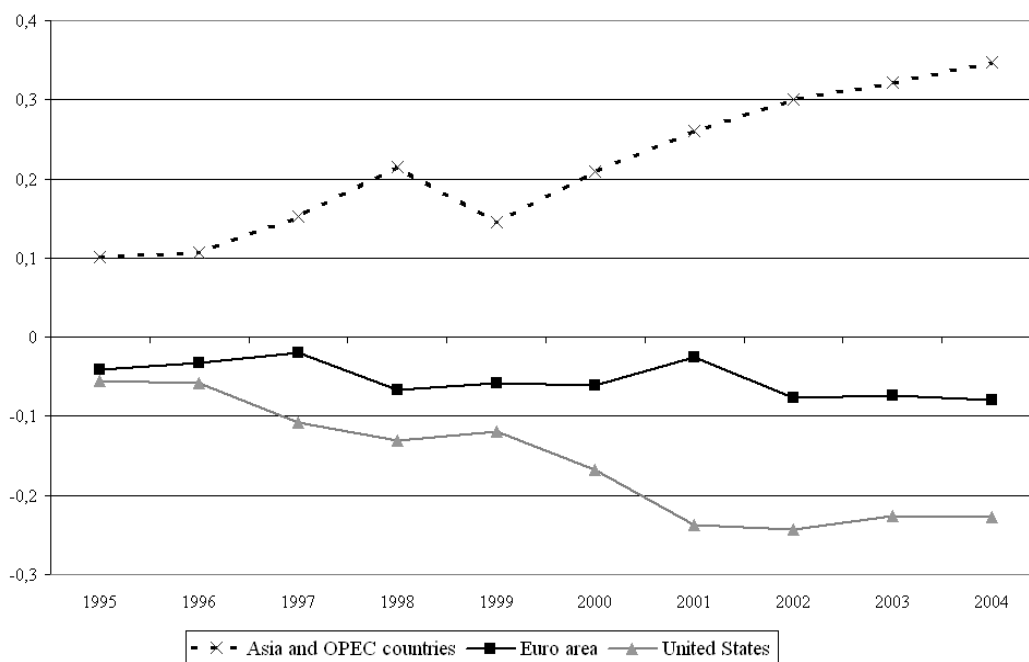


Figure 12: Evolution of Net Foreign Assets (% of GDP)
Source: Lane and Milesi-Ferretti (2007)